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Abstract

A literature has developed in labor economics regarding employer discrimination and how it may be detrimental to firms, particularly firms operating in more competitive sectors. A second literature in international trade considers the effects of import competition and export orientation on gender employment and earnings gaps. Finally, factors affecting firm survival have been increasingly studied as more panel data have become available for firms. We unite these diverse literatures and test several pertinent hypotheses from them using a 2005-2018 panel of Vietnamese firms. We find that firms with higher proportions of female labor are more likely to survive, controlling for other firm-level and industry-level characteristics, and that exporting and foreign-owned firms have higher proportions of female labor. We also examine earnings and women-run firms to consider other dimensions of firm gendering and their effects on firm survival.

Keywords: Vietnam, gender discrimination, trade competition

JEL classification: D22, F16, J16

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1. Introduction

One of the most interesting questions in the economics of gender is under what conditions might women make progress in the labor market. While women operate at a disadvantage in most labor market situations, there are also places where and times when the gender gaps in earnings and employment narrow. If we have a fuller understanding of when these situations occur, we can try to reduce gender disadvantages more systemically and systematically.

One of the oldest ideas in the economics of discrimination is that discrimination can be costly for those practicing it and thus that it will be harder to discriminate when competition is greater. In Becker's original model of firm discrimination (1957), if firms are willing to sacrifice some profit in order to favor the hiring of one group over another, this can only persist if there is market power that leads to some economic profit that can be "spent" on this preference, as the preferred type of labor will have its price driven up and thus increase costs for the firms exercising this preference. While other models of discrimination have been proposed, not all of which have this particular conclusion, no other model is designed to cover all situations, and thus this particular model of employer or firm discrimination is still of interest. In particular, the implication is that as markets become more competitive, then employer discrimination should be reduced, and that the level of competition across economic sectors should be negatively correlated with gender discrimination (and positively correlated with higher employment and earnings for women), all else equal. Forces that might increase competition and thus reduce discrimination could include greater competition both within countries and between countries, so as countries open up to greater volume of trade, this should generate additional dynamics of variation across sectors as both import substitution and export orientation may occur in different areas of the economy.

This line of argumentation implies that firm life, or survival, should also be related to firm employment composition as well as the competitiveness of the industry in which the firm operates. If firms in competitive industries have more pressure to control costs, they will move towards lower cost labor sources, all else equal. Since women tend to be the lower cost labor source, this will tend to increase their employment and also potentially increase their wages relative to men (both from women's wages rising and men's wages falling). In particular, when industries become more competitive, this may stimulate increases in female employment both because new entrants will have relatively more women employees, because existing firms

change their practices to hire more low-cost labor, and because firms that do not change will be less likely to survive. In competitive equilibrium, if male labor and female labor are equally productive, wages would equilibrate to a level between the female and male wage before conditions change and the gender gap in earnings would disappear, while we would also expect a higher female to male employment ratio in the industry than prior to the change, as women increase their labor supply to the industry in response to the increased wage and men reduce theirs.

While these implications of the employer discrimination theory can be tested using a variety of potential data sources, Vietnam provides a particularly interesting case for testing these hypotheses. Vietnam is in many ways a success story for the power of opening markets to raise standards of living and create the conditions for potential improvements in gender equality. Since Vietnam underwent structural changes in 1986 that moved it away from a socialist model, it has gone through additional waves of openness: reducing the role of state enterprises; opening up increasingly to trade with other nations; becoming open to foreign direct investment—and in general encouraging the development of a competitive private sector.

In addition, Vietnam has robust and thorough firm- and enterprise-level data collection that allows us to follow its formal sector firms over substantial spans of time to observe their lifecycles. This allows us to calculate survival rates for firms and see if their survival is affected by their percentage of female employment, as well as seeing whether competitive sectors exhibit increased employment of women and higher relative wages for women over time. Thus the major contribution of this paper is to add to the small literature on how firm survival is affected by the gender composition of employment, using data for a country that is in transition to higher economic development status and is undergoing changes in trade openness. In addition, the paper contributes by considering whether changes in the gender composition of employment occur because of changes in the behavior of existing firms, because of differential survival of firms with lower proportions of female employment, or because of the composition of new entrants.

Regarding the subsequent layout of the paper: Section 2 reviews the relevant literature, Section 3 explains the data and empirical methodology. Section 4 displays and discusses our empirical results, and Section 5 concludes.

2. Literature Review

Following on Becker's originally proposed theory of employer discrimination, a number of writers have subsequently tested his argument that employer discrimination can only persist in product markets where there is market power, because otherwise discriminating firms would be driven out by nondiscriminating firms with lower labor costs due to hiring the discriminated-against group. The general idea that increased competition tends to lead to more hiring of women in particular has been tested numerous times (cf. Kawaguchi 2007), mainly on developed country data sources, and been borne out in general and has been linked in particular to the idea that globalization increases competition in affected product markets (cf. Black and Brainerd 2004).

The specific idea of whether gender discriminatory firms can survive in competitive markets has been considered in two recent papers. Weber and Zulehner (2014) find that survival rates are lower for Austrian firms that have lower shares of female employees relative to the industry average, but that surviving firms that start out with lower shares of female employees increase their share of female workforce over time. Cooke et al. (2019) find a similar pattern in Portuguese data that employers with higher shares of female workforce to begin with grow faster. Weber and Zulehner (2010), again using Austrian data, show that start-up firms with female first hires persist more and are more successful. This body of evidence raises the question of what exactly are the mechanisms of change: is it existing firms that change, firms that refuse to change that drop out, and/or new firms that come in with higher proportions of women?

We expand competition to include not only measures of industry concentration but also trade liberalization. In small countries, it may well be that the main aspect of competition is with firms from outside the country rather than inside the country, both as the country's firms deal with pressure from imports in their markets, and as they attempt to become exporters themselves and must compete in the world market. Thus, for both firms operating in markets with ongoing import substitution and for firms who are themselves exporters, trade liberalization would conceivably be linked to greater use of female labor. If the increased demand for labor is significant, we would also expect to see rising female wages both in specific sectors and for the country as a whole, though likely not enough to equalize the gender wage differential. In particular, we might see wages rise for the less well-paid women workers, whether by demographics, geographics, or skill level. Indeed, Barros and Silva (2020) find that trade liberalization in Brazil increased nonwhite women's wages relative to those of men and white

women, but that there was less of a wage-increasing effect at the top end of the female wage range. Kis-Katos et al. (2018), using Indonesian data, find differences across regions related to input tariff reductions, where women's work participation rose more in regions with more exposure to these reductions. Chen and Hu (2023), using Chinese data, find both higher female employment representation and higher relative gender wages in exporting firms, and argue that the patterns they find appear because of the cost competition motivation rather than for exploitation of gender-linked comparative advantage. Juhn et al. (2014), using Mexican data, find that exporters increase their use of labor-reducing technology that reduces the male wage advantage and leads to more use of female blue-collar workers in place of male blue-collar workers. A counterexample from the wealthy country case of Norway finds that exporting firms may increase the gender wage gap because of the need for their employees to work different hours and be on call more for challenges related to being in the export sector (Bøler et al. 2018). A more nuanced argument is advanced by Ben Yahmed (2023), using Uruguayan data, that while opening domestic markets to import substitution increases competition and reduces gender discrimination, that opening up to more exporting can increase profits for firms in noncompetitive sectors and thus increase gender discrimination. Finally, Lennon and Schneebaum (2023) argue that opening up to trade has an effect on the gender employment ratio through creating a channel by which norms regarding gender equality (or inequality) are transmitted; interestingly they find this appears to increase women's employment for low- and mid-level positions, but that it appears to decrease women's employment in high-level positions.

Vietnam, similar to the countries mentioned herein, has gone from being a closed economy to a highly open economy. While the country has increasingly opened to international trade starting in 1986, the most striking event over the recent economic history of Vietnam is likely its WTO entry in 2007. A number of papers have concentrated on the effects of this entry on the Vietnamese economy, including the differential effects on private firms vs. state-owned enterprises, the increases in productivity for private firms, and the higher probability of exit and lower firm profitability subsequent to WTO entry (Baccini et al. 2019). Comparisons of household income inequality over this era (both pre and post WTO entry) show that national income inequality has dropped and income levels have risen, even though there are still areas of lower income growth in rural areas and among minorities; much of this drop is due to the increased importance of labor income as a source of household income (Benjamin et al. 2017).

Poverty rates were already dropping substantially before the WTO entry (again with the caveat that these drops were not shared equally across urban and rural areas, and across parts of the country) and commentators were generally crediting increased trade liberalization—in particular the increased volume of exports rather than any negative effects of import substitution (Kien and Heo 2009; Le et al. 2019)—for these improvements in the earlier period (notably, exports per capita tripled from 1985 to 1990—see Heo and Doanh 2009: Table 7), ever since free market reforms began with a regime change in late 1986. Indeed, the 2001 US-Vietnam Bilateral Trade Agreement also seems to have stimulated wage growth and poverty reductions in Vietnam (McCaig 2011).

Vietnamese firms with global ties (exporters, multinational enterprises, and domestic firms that operate in global value chains) all appear to provide more opportunities for women workers (Coniglio and Hoxhaj 2022), including a wage premium for women with lower levels of education if they work in foreign firms (Fukase 2014). The global value chain relationship implies that the increased demand for female labor in Vietnam is mainly for low-skilled woman workers concentrated in the lower-value-added part of the supply chains (Pham and Jinjarak 2023). However, Vietnamese firms with more investment in information and communication technology have also displayed more demand for female workers (Chun and Tang 2018). The environment for firms in Vietnam appears to be highly competitive, even for the remaining state-owned enterprises. Turnover rates are high in the informal business sector in Vietnam, with entry around 15 percent and exit around 19 percent annually (McCaig and Pavcnik 2021). Factors affecting formal business sector firm survival are similar to those found in studies for comparable countries (e.g., China), including positive effects of IT investment, and difficulty surviving as small competitors in more concentrated sectors (Thi 2022); that said, overall concentration appears to be quite low in Vietnam based on the measures that we calculate below. Continuous exporter status is positively related to survival (Vu and Lim 2013). However, foreign direct investment effects on survival of domestic firms in Vietnam appear relatively small (Kokko and Thang 2014).

Aside from the question of whether competition undercuts employer gender discrimination, a number of papers have considered other factors that might lead to higher numbers of women employees and higher earnings for women employees relative to male employees. One question is whether women moving into business leadership positions, such as

firm owner or board membership, leads to elevated rates of change. This relationship could still be related to the profit mechanism of substituting lower-cost female labor for higher-cost male labor if women leaders are more willing to make these substitutions. But it could also be that women leaders might institute additional cost-effective business practices, or alternatively, that they discriminate in favor of, or against, female employees. Results are mixed to date on the effects of female ownership and gender board diversity. Yasuda (2023) argues that having a woman as employer has an effect on the employment of women, but that it varies depending on what the woman employer's stereotyped beliefs are regarding woman workers rather than being unambiguously positive or negative in sum for women's employment. Fang et al. (2022), using an international sample from the World Bank enterprise surveys, find that women-led firms tend in general to have lower levels of labor productivity and growth in labor productivity, but similar total factor productivity to men-led firms. Dutch and Danish data show no effect of gender board diversity and firm performance (Marinova et al. 2016). Meanwhile, Indian and Singaporean data show that gender board diversity does have a positive and significant effect on firm performance (Duppati et al. 2020). We consider the gender of firm ownership in this paper but are unable to determine the board diversity for our sample.

3. Data and Empirical Methodology

As mentioned in the Introduction, Vietnam has a significant data collection program with both national labor force survey data and firm data available for much of the twenty-first century. We use firm-level data for our analysis, but we also look at readily-available labor force survey data to see overall patterns from that source and compare it to our data.

International Labour Organization (ILO) data are available online for around the same time frame as our firm-level data sample give national and sector-level patterns of interest from the labor force survey data for the years near our time period (https://ilostat.ilo.org/data/country-profiles/?ref_area=VNM). The ILO data show a significant shift out of agriculture for much of the employed population, with a drop from 46 percent of the workforce in 2007 to 30 percent by 2022. Figure 1 shows the changes in the share of female workers in the labor force (15–64-year-olds) between 2007 and 2022 in Vietnam by industry. Women's employment has risen over this period in absolute numbers, but their representation in the labor market has stayed relatively constant at around 48 percent of the labor force. However, they have increased their

representation in industry (as opposed to services) from 33 to 41 percent over this period and decreased their representation in agriculture from 48 to 31 percent, while the percentage of female in services has stayed relatively constant (a drop from 53 percent to 52 percent female). Figure 2 demonstrates that the percentage female in management has risen from 20.5 percent in 2007 to 25.6 percent by 2022, but the percentage female in senior and middle management stayed essentially constant (16.3 percent in 2007; 16.8 percent by 2022).

Figure 3 shows the female-to male earnings ratio in the ILO data. The overall female to male monthly earnings ratio fluctuated from 85 percent to 93 percent over this 2007-2022 time period, but has ended up no different by the end of the time period (landing at 89 percent in both 2007 and 2022). However, the gender earnings ratio in manufacturing has risen substantially, from 75 percent in 2007 to 87 percent by 2022. Notably, women's earnings have fallen in agriculture (from 83 percent in 2007 to 69 percent of men's monthly earnings by 2022) and also evinced little change over the longer run in a variety of service occupations (87 percent to 86 percent now, although they rose for a while in the mid 2010s). Thus, it is not surprising that the overall ratio has seen no change given these sectoral differences, but notable that without the rise in women's manufacturing wages, their relative earnings would have dropped overall.

Data and Variable Descriptions

In our main analyses, we use the Vietnamese Enterprise Survey (VES) data, which are from the General Statistics Office in Vietnam. The VES annually collects financial statements of Vietnam's entire universe of enterprises. Our data span 14 years, from 2005 to 2018. This data period starts two years before Vietnam's WTO entry, a major globalization event that increased Vietnam's competition levels across industries (Baccini et al., 2019); the data period ends before the COVID-19 pandemic to avoid potential disruptions in the analysis. The survey uses the Vietnam Standard Industrial Classification (VSIC), whose 2-digit categories are identical to those of the International Standard Industrial Classification (ISIC), revision 4.

For our main sample, we exclude very small firms, requiring firms to have at least five employees at the beginning of the sample period (or when they come into the sample). Firms in the construction and tourism sectors are excluded due to seasonality. We exclude firms that do not state their establishment year at any point, firms that do not have consecutive years of operation, and firms established before 2005. This yields a sample of 558,880 observations for

94,840 firms. For our survival analysis based on the main sample, the first year's observation from every firm is excluded because explanatory variables are lagged by one year. Therefore, the survival analysis has a sample of 464,040 observations for the same number of firms. We use more inclusive samples for the robustness checks in Section 4.

We consider four measures of the degree of competition or concentration for use as independent variables in our analyses. The first is the Herfindahl-Hirschman Index (HHI), $HHI_{jt} = \sum_{i=1}^{N_{jt}} s_{ijt}^2$, where i indicates firm, j indicates industry, s is firm i 's market share in industry j in year t , and N_{jt} is the number of firms in industry j in year t . The second measure is the industry-level Lerner index defined as $lerner_index_{jt} = \frac{1}{N_{jt}} \sum_{i=1}^{N_{jt}} \frac{profit_{ijt}}{sales_{ijt}}$. Profit is calculated as sales minus cost, which is available in the VES. The HHI and the Lerner index are bounded between 0 and 1; lower values of the two measures mean more competition.

The third measure is the degree of import penetration, the share of total imports over domestic production: $import_penetration_{jt} = \frac{imports_{jt}}{\sum_{i=1}^{N_{jt}} sales_{ijt}}$. The import data are from the World

Integrated Trade Solution (WITS). Import penetration is undefined for the wholesale and retail industries because the WITS does not report import values for these industries. The fourth and last measure is the share of exporters each year, measured at the 2-digit ISIC code level:

$export_share_{jt} = \frac{1}{N_{jt}} \sum_{i=1}^{N_{jt}} exporter_{ijt}$, where $exporter_{ij}$ is equal to 1 if firm i reported nonzero export values in any of the years of its existence and 0 otherwise. A higher import penetration means a higher domestic competition, and a larger share of exporters means that the industry faces more competition in the export market.

We take a three-year moving average of each of these four measures to remove potential contemporaneous feedback. Throughout, the measures are calculated by the two-digit ISIC coded industry, yielding 75 unique industries. Meanwhile, our industry dummy variables use 4-digit VSIC codes with 544 unique industries; province dummy variables account for the characteristics of 63 unique provinces in Vietnam.

Another variable of importance is the female employee share, the proxy of discriminatory taste as in Weber et al. (2014). The female employee share is the residual from the regression of female share by firm, industry (VSIC 4-digit), and year on the industry and year dummy variables. The residuals are normalized to range between 0 and 1. This measure addresses the

differences across industries and years regarding the tendency to hire more women due to job characteristics.

The female owner variable is only available in the year 2016 in the VES. We define the female owner dummy variable as 1 if a firm existed in 2016 and had a female owner; the female owner dummy is zero if a firm existed in 2016 but did not have a female owner. The industry-level female owner share is $female_owner_share_{jt} = \frac{1}{N_{jt'}} \sum_{i=1}^{N_{jt'}} female_owner_{ijt}$, where $N_{jt'}$ is the number of firms with the $female_owner_{ij}$ information in industry j in year t . Wage by gender by firm is unavailable, but the overall wage by firm in Vietnamese dong is available for all years. The foreign-owned dummy is 1 if a firm has 100 percent foreign capital or is a joint venture between domestic and foreign owners; 0 otherwise.

Table 1 exhibits descriptive statistics of the main sample. The exit variable indicates that 5.8 percent of the total observations exited the market, given that the firm existed in the year before. Because there are 94,935 unique firms in the main sample, $\frac{464,040 \times 0.058}{94,840} \times 100 = 28.4$ percent of firms exited the market in the sample during the sample period. The median survival length of firms in the main sample is 5 years. The average female share relative to a firm's industry is 0.49 as the female share variable is standardized to range between 0 and 1. Figure 4 demonstrates that the firm survival rate is higher in manufacturing, followed by service; wholesale and retail has the lowest survival rate.

The low mean HHI (0.046) and Lerner Index (0.043) at the 2-digit industry level reveal a low degree of concentration in Vietnamese industries on average. Figure 5 indicates that the long-run competition trends vary depending on the industry and the competition measure. Figure 5 plots the industry averages of each competition measure in manufacturing, service, and wholesale and retail sectors, which comprise 94 percent of the total observations. The mean HHI, i.e., the degree of concentration, has decreased in all three industries since 2010 or 2011. The Lerner index has also been decreasing since 2009 in the service sector. The aggregate Lerner index has slightly increased in manufacturing as well as wholesale and retail sectors, indicating growing profitability among firms on average. Import penetration trends in manufacturing and wholesale and retail have been steady since 2009. During the sample period, Vietnam's aggregate imports grew up six-fold in current USD. As much as imports grew, sales levels went

up proportionally in Vietnam. Finally, the share of exporters went up steadily since 2008 in all sectors.

Figure 6 plots the mean initial female share against the length (in the number of years) of firm life duration. The initial female share and the firm life duration has an overall positive relationship. The highest duration in the sample (14 years) has the highest initial female share.

The mean female owner share in Table 1 shows that about 27 percent of firms have a female owner at one point in their lifetime. The female owner share is steady across the sample period. Foreign-owned firms comprise 6.8 percent of all observations. Note that the median establishment year is 2010.

Empirical Specifications

We estimate whether the female employee share affects the firm survival as the industry-level competition evolves. Following Weber and Zulehner (2014), we use a proportional hazard model for the risk of leaving the market: The discrete hazard function,

$$h(t|\tilde{r}_i, X_i, D_i) = \lambda(t) \exp(\beta\tilde{r}_i + \gamma X_i + \delta D_i), \quad (1)$$

is the probability that firm i leaves that market in year t , where $\lambda(t)$ is the yearly hazard rate; \tilde{r}_i is the female employee share relative to the industry. X_i is a set of firm-level and industry-level covariates, including the degree of competition, and D_i includes industry, region, and year dummy variables. The coefficients of interest are β and γ . We estimate the model to see if the female employee share in the firm's labor force is positively related to survival probability, both overall and interacted with the competition measures.

We address additional questions using panel linear fixed-effect regression models. The first linear model asks whether the female employee share increases with the degree of competition:

$$\tilde{r}_i = \alpha + \gamma X_i + \delta D_i + v_i, \quad (2)$$

where α is a constant and v_i is the random error. Note that each firm has industry, year, and region information, but we use the firm identifier i only for simplicity in the regression

specification equations. The second linear model asks whether the average wage per employee is related to the female share:

$$\ln w_i = \alpha + \beta \tilde{r}_i + \gamma X_i + \delta D_i + v_i, \quad (3)$$

where $\ln w_i$ is logged per-employee wage of firm i . The third linear model regresses the female employee share on the dummy variable (E_i) that indicates whether a firm is new:

$$\tilde{r}_i = \alpha + \sigma E_i + \gamma X_i + \delta D_i + v_i. \quad (4)$$

Lastly, we repeat the survival and the first two linear analyses with a female owner dummy as an explanatory variable to understand whether the owner is female affects firm survival, female employee share, and average wage. In the next section, we present the results of the four estimation specifications in this section using the VES data.

4. Results

Our hazard rate analysis, shown in Table 2, indicates that the share of female employment reduces the probability of firm exit, a finding that is robust across model specifications and supportive of our fundamental premise. The female share coefficients are negative in all columns and statistically significant in all but two columns. Also, the last column, where exporter share and the interaction of exporter share and female share are included, indicates that the marginal effect of a higher female share on firm survival is stronger in industries with a higher exporter share.

The results of the rest of the competition measures convey various messages that are more nuanced. The HHI coefficients in Columns (3) and (4) are statistically insignificant. Notably, the level of competition is low in Vietnamese industries in general as measured by the HHI (see Table 1). The interaction term of female share and the Lerner index in Column (6) indicates that the female share's role is stronger among industries with a higher Lerner index, i.e., more profitable industries. Column (7) implies that import competition increases the hazard of exiting, but in Column (8), the effect does not interact with female share. Larger firms, as

measured by total employment, have the expected negative sign, indicating a lower probability of exit.

Table 3 shows the effects of the various measures of sectoral competition on the female share of employment for individual firms. Firms in more concentrated industries, as measured by the HHI, have lower female shares, while firms in more profitable industries, as measured by the Lerner index, have higher female shares. Import penetration, exporter share, firm size and foreign ownership are all positively related to female share. Table 4 estimates the relationship between female share and competition by broad sectors. Here, we see that the negative effect for HHI is driven by the effect in manufacturing and service, while the negative effects for the Lerner index and exporter share are evident in service. Competition has an insignificant effect on female share in wholesale and retail. Note that the import penetration is undefined for wholesale and retail industries. In manufacturing and service industries, the import penetration coefficients are statistically insignificant; we omitted the results in Table 4 to save space.

We see from Table 5 that new firms are likely to have a low female share. The implication is that growth in female share over time in an industry comes not from new entrants, but rather from existing (or surviving) firms that increase their share of female employees. In these regressions, new firms in more concentrated industries, as measured by the HHI, have lower female shares, while firms in more profitable industries, as measured by the Lerner index, have lower female shares. Exporters have a higher female share, as do larger firms and foreign-owned firms, and the interaction of exporter with new firm is also positive. So new entrants in the most competitive industries do appear to have higher female shares. Being a new firm, however, has a relatively smaller impact on female share: The absolute values of the new-firm coefficients are about one tenth of the size of foreign ownership coefficients.

Table 6 shows a positive relationship between overall wage and the female share in the firm. Firms in more concentrated industries as measured by the HHI and exporters have higher wages, with this effect being mitigated for the firms with higher shares of female workers. Firms in less profitable industries as measured by the Lerner index have lower wages, with this effect being mitigated for the firms with higher shares of female workers. Larger firms and foreign-owned firms also have higher wages. Import penetration is insignificant.

For the firms where we can identify the presence or absence of a female owner, we look to see how that variable modifies the previous four analyses, as shown in Table 7. Firms with

female owners have higher probabilities of exiting the industry, *ceteris paribus*. The negative effect of female owners on firm survival is more pronounced in firms with higher female employee share. Firms that have female owners have a lower wage, and firms with a higher female employee share also have a lower wage on average. However, firms that have female owners and also have a high share of female employees have a net wash on these effects on the wages paid by the firm. These effects also net out for new firms with female owners, where the negative effect of being a new firm on female employment is balanced by the higher rate of female employment for female owned firms.

Our estimation results provide evidence that supports the Beckerian theory of employer discrimination and its relationship with market competition as it appears that firms that employ a higher share of females, a disadvantaged group with lower wages, survive better in an increasingly competitive market. In other words, a competitive market environment reduces gender discrimination. Furthermore, our results unveil a deeper layer of the mechanism through which high-female-employee-share firms survive better when facing competition. New firms tend to have a lower female employee share, which suggests that surviving firms hire more women than men as they mature. Exporting firms and multinational firms hire more women, and firms that hire more women tend to pay higher wages. We also shed light on the behavior and survival of female-owned firms. They have a lower chance of survival, but, for firms with a high share of female employees, female-owned firms pay better. It is meaningful to find support for the Beckerian theory using the case of a developing country as we do in this paper.

Robustness checks

We run extended samples of our firms, separately constructed for the survival and linear analyses, to see if our results are robust with respect to selection into the sample. For our survival analysis, we compare the main sample to results that include firms established before 2005 (according to their establishment year date) as robustness checks, yielding 660,302 observations on 122,205 firms. For our linear analyses, we compare the main sample to a larger sample that includes firms with or without the establishment year information, which is required only for survival analysis; this sample has 2,537,684 observations on 419,941 firms.

The descriptive statistics of the extended samples are found in Table 8 and offer a similar picture to the main sample. Due to the inclusion of more firms that survived longer than the firms in the main sample, the mean employment is higher in the extended sample than in the main sample. The median survival length is 6 years in the extended sample for survival analysis.

Table 9 repeats the survival analysis using the extended sample summarized in Panel A of Table 8. The results are consistent with Table 2. Note that the insignificant interaction term of HHI and female share in Column (4) of Table 9 is consistent with the fact that HHI is low and not influencing the effect of female share on firm survival. Tables 10 and 11 use the extended sample for linear analyses summarized in Panel B of Table 8. This last sample is the largest and the most comprehensive among the three samples. The results from the main sample that new firms hire less women (Table 5) and the overall positive relationship between female employee share and wages (Table 6) remain robust to using the extended sample.

5. Conclusion

This paper has attempted to link the literature on the effects of competition on the ability of employers to discriminate in favor of male workers to the literature on competition caused by the opening of trade. It also uses a unique panel of firms from Vietnam to see if firms increase their percentage of female employees in response to competitive pressures and whether firms improve their survival probabilities by increasing their percentage of female employees. We also look to see if these effects are driven by new entrants or by existing firms modifying their behavior. We also look to see if there are wage effects of increased percentage of female employees and whether or not the presence of female ownership in the sector modifies these effects. We find supporting evidence for both the idea that firms increase their percentage female in response to competitive pressures, and the idea that this move improves their survival probability. As such, it indicates that firms may well discriminate in favor of male labor if they have the ability to do so, but that they respond to competitive pressure by reducing their discriminatory patterns.

Clearly it would be interesting to see if similar results are found for other panels of firms. While there are things about Vietnam that are somewhat unique in terms of the great opening to

trade that occurs over this time period in Vietnam, it is likely that other competition-altering factors have occurred in other countries and that their effects similarly could be measured in terms of their effects on women's earnings and employment as well as on firms' survival probabilities.

We also find some puzzling effects in terms of the interpretation of various measures of competitiveness. The lack of clarity about what the results regarding the Lerner index are telling us may relate to the complexity of how these indexes relate to the conditions that individual firms face. For example, in the case of the Lerner index, are firms less profitable because they have already raised their cost structure by hiring more expensive labor? Or is this an innate measure of the degree of competition in the industry, in which case the results appear at odds with the Herfindahl index results?

It is nonetheless interesting to see firms apparently reacting to changes in their competitive conditions and in ways that can change the relative well-being of different demographic groups. While trade openness does not automatically guarantee better outcomes for countries, these demographic effects, which appear to favor the less well-off workers, are a notable outcome from the increase in international trade.

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Table 1. Summary Statistics of the Main Sample

Variable	Obs	Mean	Std. dev.	Min	Max
Exit (Firm death)	558,880	0.058	0.234	0	1
Female share relative to the industry	558,880	0.493	0.098	0	1
2-digit ISIC HHI	558,880	0.046	0.060	0.004	1
2-digit ISIC Lerner Index	558,865	0.043	0.033	0.002	0.496
2-digit ISIC Import Penetration	156,981	0.607	1.037	0.0003	13.782
2-digit ISIC Exporter Share	558,880	0.119	0.111	0	0.624
2-digit ISIC Female owner share	558,878	0.268	0.073	0	1
Employment (1000 employees)	558,880	0.042	0.319	0.001	66.850
Wage per employee (Logged)	461,544	3.955	0.855	0	12.646
Sales per employee (Logged)	558,880	5.766	1.774	-6.908	16.642
Profit per employee (Logged)	321,758	1.773	1.945	-8.170	12.668
Foreign-owned	558,880	0.068	0.251	0	1
Year	558,880	2013.353	3.419	2005	2018

Notes: All 2-digit ISIC level variables are 3-year moving averages. There are 63 provinces, 75 2-digit industries, and 544 4-digit industries. The median survival length of a firm is 5 years.

Table 2. Results of the survival analysis using the main sample

Dependent variable: The hazard rate of exiting (firm "death")

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Female share	-0.348*** (0.0618)	-0.235*** (0.0614)	-0.235*** (0.0614)	-0.278*** (0.0785)	-0.235*** (0.0614)	-0.0864 (0.0978)	-0.273** (0.118)	-0.282** (0.129)	-0.237*** (0.0614)	-0.0578 (0.0884)
HHI			0.0632 (0.0972)	-0.301 (0.406)						
(Female share)*HHI				0.750 (0.814)						
Lerner Index					0.328 (0.274)	1.969** (0.895)				
(Female share)*(Lerner Index)						-3.360* (1.763)				
Import Penetration							0.0552*** (0.00996)	0.0483 (0.0438)		
(Female share)*(Import Penetration)								0.0139 (0.0856)		
Exporter Share									-0.350*** (0.122)	0.492 (0.329)
(Female share)*(Exporter share)										-1.767*** (0.654)
Employment		-4.387*** (0.420)	-4.388*** (0.420)	-4.391*** (0.421)	-4.390*** (0.420)	-4.390*** (0.421)	-2.686*** (0.247)	-2.686*** (0.247)	-4.349*** (0.421)	-4.296*** (0.422)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	464,040	464,040	464,040	464,040	464,029	464,029	129,335	129,335	464,040	464,040

Notes: Robust standard errors in parentheses. *** p < .01, ** p<.05, * p<.10

Table 3. Female share as a function of sector competition level for all industries

Dependent Variable: Female share relative to industry								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HHI	-0.0129*** (0.00399)	-0.00957** (0.00393)						
Lerner Index			0.0138 (0.0118)	0.00828 (0.0117)				
Import Penetration					0.00181*** (0.000459)	0.00167*** (0.000457)		
Exporter Share							0.0334*** (0.00454)	0.00750* (0.00450)
Employment		0.0104*** (0.00155)		0.0104*** (0.00155)		0.0107*** (0.00177)		0.0104*** (0.00155)
Foreign-owned		0.0406*** (0.000706)		0.0406*** (0.000706)		0.0449*** (0.00106)		0.0406*** (0.000707)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	558,880	558,880	558,864	558,864	156,981	156,981	558,880	558,880
R-squared	0.018	0.029	0.018	0.029	0.043	0.067	0.018	0.029

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4. Female share as a function of sector competition level by broad sectors

Dependent Variable: Female share relative to industry

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sector	Manufacturing			Wholesale and retail			Service		
HHI	-0.0252*** (0.00661)			-0.00185 (0.00973)			-0.0221*** (0.00708)		
Lerner Index		0.0573 (0.0444)			0.0190 (0.0378)			-0.0327** (0.0144)	
Exporter Share			0.00571 (0.00687)			-0.00906 (0.0154)			-0.0278*** (0.0101)
Employment	0.0106*** (0.00178)	0.0106*** (0.00178)	0.0106*** (0.00178)	-0.00893** (0.00356)	-0.00892** (0.00356)	-0.00894** (0.00356)	-0.00224 (0.00166)	-0.00224 (0.00166)	-0.00224 (0.00166)
Foreign-owned	0.0446*** (0.00108)	0.0446*** (0.00108)	0.0446*** (0.00108)	0.0217*** (0.00168)	0.0217*** (0.00168)	0.0217*** (0.00168)	0.0341*** (0.00115)	0.0341*** (0.00115)	0.0343*** (0.00115)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	150,884	150,884	150,884	234,058	234,052	234,058	143,634	143,625	143,634
R-squared	0.072	0.072	0.072	0.036	0.036	0.036	0.021	0.021	0.021

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5. Female share as a function of whether a firm is newly founded

Dependent Variable: Female share relative to industry

	(1)	(2)	(3)	(4)	(5)
New firm	-0.00327*** (0.000341)	-0.00405*** (0.000425)	-0.00282*** (0.000478)	-0.00579*** (0.000773)	-0.00483*** (0.000484)
HHI		-0.0107** (0.00450)			
(New firm)*HHI		0.00376 (0.00497)			
Lerner Index			0.0152 (0.0121)		
(New firm)*(Lerner Index)			-0.0239*** (0.00919)		
Import Penetration				0.00202*** (0.000511)	
(New firm)*(Import Penetration)				-0.00109* (0.000598)	
Exporter Share					0.00753* (0.00450)
(New firm)*(Exporter share)					0.00888** (0.00381)
Employment		0.0103*** (0.00154)	0.0103*** (0.00154)	0.0106*** (0.00175)	0.0103*** (0.00154)
Foreign-owned		0.0408*** (0.000705)	0.0408*** (0.000705)	0.0450*** (0.00106)	0.0407*** (0.000707)
Observations	558,880	558,880	558,864	156,981	558,880
R-squared	0.018	0.029	0.029	0.067	0.029

Notes: Year, industry, and province fixed effects are included. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6. Average wage per employee as function of female share

Dependent Variable: Average wage per employee

	(1)	(2)	(3)	(4)	(5)
Female share	0.204*** (0.0116)	0.0771*** (0.0138)	0.0723*** (0.0195)	-0.198*** (0.0227)	0.225*** (0.0168)
HHI		0.306*** (0.0946)			
(Female share)*HHI		-1.344*** (0.186)			
Lerner Index			0.659*** (0.196)		
(Female share)*(Lerner index)			-1.219*** (0.361)		
Import Penetration				-0.000963 (0.0100)	
(Female share)*(Import Penetration)				0.00211 (0.0181)	
Exporter share					1.324*** (0.0516)
(Female share)*(Exporter share)					-1.527*** (0.0886)
Employment		0.00253 (0.00246)	0.00179 (0.00246)	0.0126*** (0.00265)	0.00505** (0.00245)
Foreign-owned		0.676*** (0.00499)	0.675*** (0.00498)	0.421*** (0.00620)	0.675*** (0.00503)
Observations	461,541	461,541	461,525	126,540	461,541
R-squared	0.417	0.451	0.450	0.450	0.451

Notes: Year, industry, and province fixed effects are included. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7. Analyses with female owner share

Dependent variable	Hazard rate of exiting		Wage	Female share	
	(1)	(2)	(3)	(4)	(5)
Female share relative to the industry	-0.201*	-0.401***	-0.365***		
	(0.122)	(0.149)	(0.0424)		
Female owner share	0.0567**	-0.239*	-0.947***	0.0754***	0.0756***
	(0.0281)	(0.130)	(0.0895)	(0.00752)	(0.00761)
(Female share)*(Female owner share)		0.588**	1.396***		
		(0.253)	(0.150)		
New firm					-0.00398***
					(0.00127)
(New firm)*(Female owner share)					0.000419
					(0.00464)
Employment	-3.115***	-3.094***	0.00239	0.0104***	0.0103***
	(0.701)	(0.699)	(0.00245)	(0.00155)	(0.00154)
Foreign-owned			0.677***	0.0408***	0.0409***
			(0.00500)	(0.000706)	(0.000706)
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes
Observations	379,274	379,274	461,540	558,878	558,878
R-squared			0.450	0.029	0.029

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 8. Summary Statistics of the Extended Samples

A. Extended Sample for Survival Analysis

Variable	Obs	Mean	Std. dev.	Min	Max
Exit (Firm death)	782,507	0.062	0.241	0	1
Female share relative to the industry	782,507	0.494	0.097	0	1
2-digit ISIC HHI	782,507	0.040	0.059	0.003	1
2-digit ISIC Lerner Index	782,499	0.044	0.034	0.005	0.500
2-digit ISIC Import Penetration	239,885	0.648	1.242	0.000	25.995
2-digit ISIC Exporter Share	782,507	0.141	0.119	0	0.838
2-digit ISIC Female owner share	782,474	0.265	0.072	0	1
Employment (1000 employees)	782,507	0.058	0.519	0.001	87.279
Wage per employee (Logged)	653,344	3.885	0.876	0	12.646
Foreign owned	782,507	0.071	0.256	0	1
Year	782,507	2012.566	3.799	2005	2018

B. Extended Sample for Linear Regressions

Variable	Obs	Mean	Std. dev.	Min	Max
Female share relative to the industry	2,537,684	0.467	0.093	0	1
2-digit ISIC HHI	2,537,684	0.020	0.036	0.002	1
2-digit ISIC Lerner Index	2,537,675	0.044	0.032	0.001	0.330
2-digit ISIC Import Penetration	609,355	0.692	1.331	0.000	25.995
2-digit ISIC Exporter Share	2,537,684	0.093	0.103	0	0.744
2-digit ISIC Female owner share	2,537,680	0.243	0.087	0	1
Employment (1000 employees)	2,537,684	0.049	0.414	0.001	87.279
Wage per employee (Logged)	1,979,223	3.833	0.857	0	17.881
Foreign owned	2,537,684	0.043	0.202	0	1
Year	2,537,684	2012.863	3.736	2005	2018

Notes: All 2-digit ISIC level variables are 3-year moving averages. In the first sample in Panel A, there are 64 provinces, 86 2-digit industries, and 662 4-digit industries. In the second sample in Panel B, there are 66 provinces, 92 2-digit industries, and 729 4-digit industries.

Table 9. Robustness Checks: Results of the survival analysis using the extended sample

Dependent variable: The hazard rate of exiting (firm "death")

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Female share relative to the industry	-0.275*** (0.0500)	-0.153*** (0.0498)	-0.153*** (0.0498)	-0.165*** (0.0603)	-0.153*** (0.0498)	-0.0852 (0.0819)	-0.257*** (0.0883)	-0.260*** (0.0948)	-0.157*** (0.0499)	0.0639 (0.0744)
HHI			0.107 (0.0806)	-0.0154 (0.328)						
(Female share)*HHI				0.248 (0.646)						
Lerner Index					0.481** (0.238)	1.218 (0.761)				
(Female share)*(Lerner Index)						-1.501 (1.486)				
Import Penetration							0.0314*** (0.00543)	0.0292 (0.0232)		
(Female share)*(Import Penetration)								0.00453 (0.0456)		
Exporter Share									-0.339*** (0.0845)	0.505** (0.234)
(Female share)*(Exporter share)										-1.749*** (0.458)
Employment		-2.487*** (0.217)	-2.488*** (0.217)	-2.488*** (0.217)	-2.490*** (0.217)	-2.489*** (0.217)	-1.942*** (0.150)	-1.942*** (0.150)	-2.471*** (0.216)	-2.433*** (0.217)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	660,302	660,302	660,302	660,302	660,294	660,294	202,291	202,291	660,302	660,302

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 10. Robustness Checks: Female share as a function of whether a firm is newly founded using the extended sample for linear analyses

Dependent Variable: Female share relative to industry

	(1)	(2)	(3)	(4)	(5)
New firm	-0.00493*** (0.000156)	-0.00474*** (0.000177)	-0.00291*** (0.000251)	-0.00995*** (0.000400)	-0.00342*** (0.000208)
HHI		0.00531 (0.00345)			
(New firm)*HHI		0.0216*** (0.00474)			
Lerner Index			0.0509*** (0.00663)		
(New firm)*(Lerner Index)			-0.0316*** (0.00512)		
Import Penetration				-0.000332** (0.000147)	
(New firm)*(Import Penetration)				0.000260 (0.000256)	
Exporter Share					0.0409*** (0.00326)
(New firm)*(Exporter share)					-0.0100*** (0.00184)
Employment		0.00584*** (0.000389)	0.00583*** (0.000389)	0.00916*** (0.000665)	0.00578*** (0.000386)
Foreign-owned		0.0391*** (0.000370)	0.0391*** (0.000370)	0.0465*** (0.000533)	0.0390*** (0.000369)
Observations	2,537,684	2,537,684	2,537,675	609,355	2,537,684
R-squared	0.020	0.027	0.027	0.055	0.027

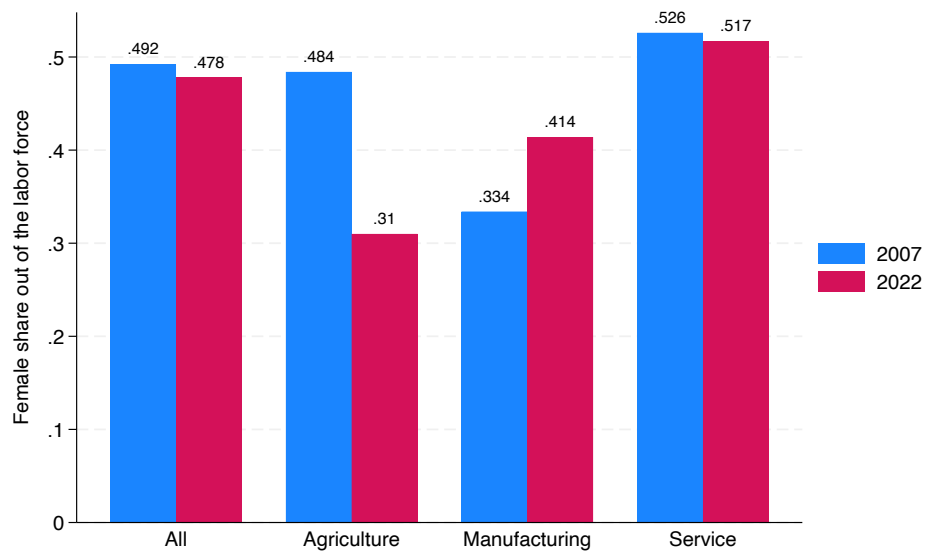
Notes: Year, industry, and province fixed effects are included. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 11. Robust checks: Average wage per employee as function of female share

Dependent Variable: Average wage per employee	(1)	(2)	(3)	(4)	(5)
Female share	0.148*** (0.00551)	0.0386*** (0.00615)	0.0158* (0.00935)	-0.180*** (0.0118)	0.233*** (0.00748)
HHI		0.624*** (0.0726)			
(Female share)*HHI		-0.985*** (0.147)			
Lerner Index			-0.598*** (0.0912)		
(Female share)*(Lerner index)			0.0318 (0.169)		
Import Penetration				0.0206*** (0.00373)	
(Female share)*(Import Penetration)				-0.0417*** (0.00777)	
Exporter share					1.227*** (0.0304)
(Female share)*(Exporter share)					-1.988*** (0.0472)
Employment		0.0248*** (0.00210)	0.0245*** (0.00208)	0.0232*** (0.00214)	0.0292*** (0.00236)
Foreign-owned		0.619*** (0.00267)	0.618*** (0.00267)	0.464*** (0.00312)	0.629*** (0.00269)
Observations	1,979,221	1,979,221	1,979,215	469,431	1,979,221
R-squared	0.432	0.453	0.453	0.496	0.454

Notes: Year, industry, and province fixed effects are included. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 1. Female share of the labor force in Vietnam, 2007 and 2022



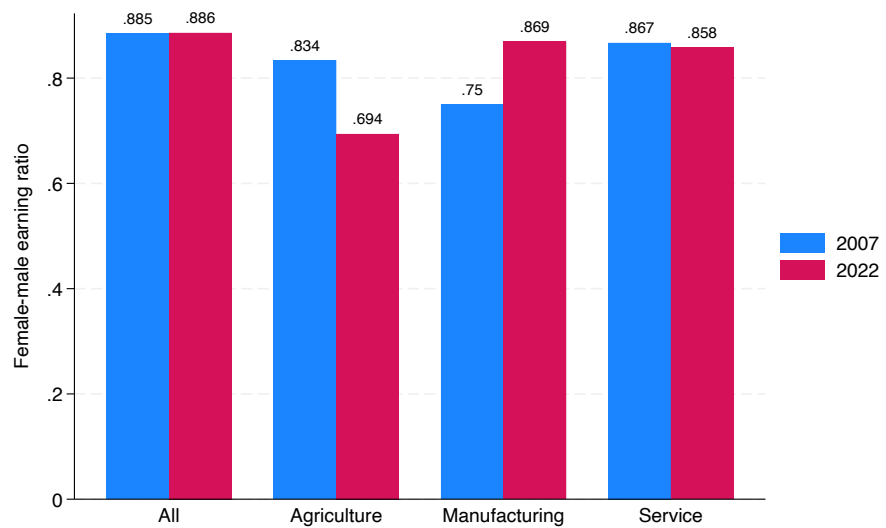
Source: ILO data

Figure 2. Share of female managers in Vietnam, 2007 and 2022



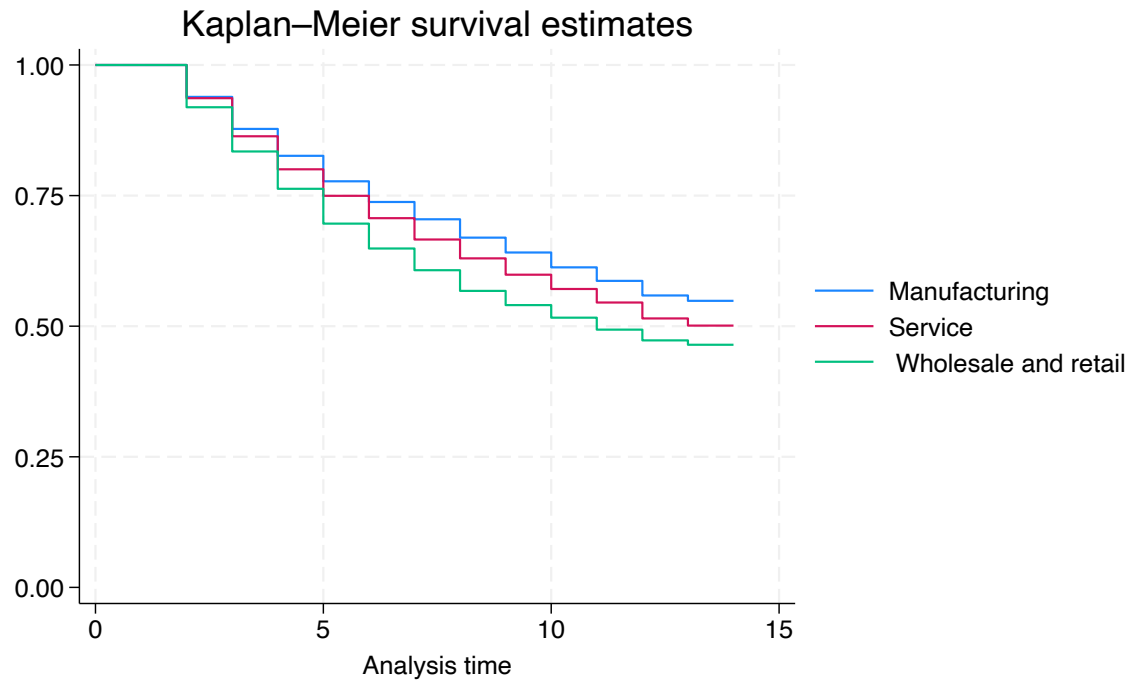
Source: ILO data

Figure 3. The female-male earnings ratio in Vietnam, 2007 and 2022



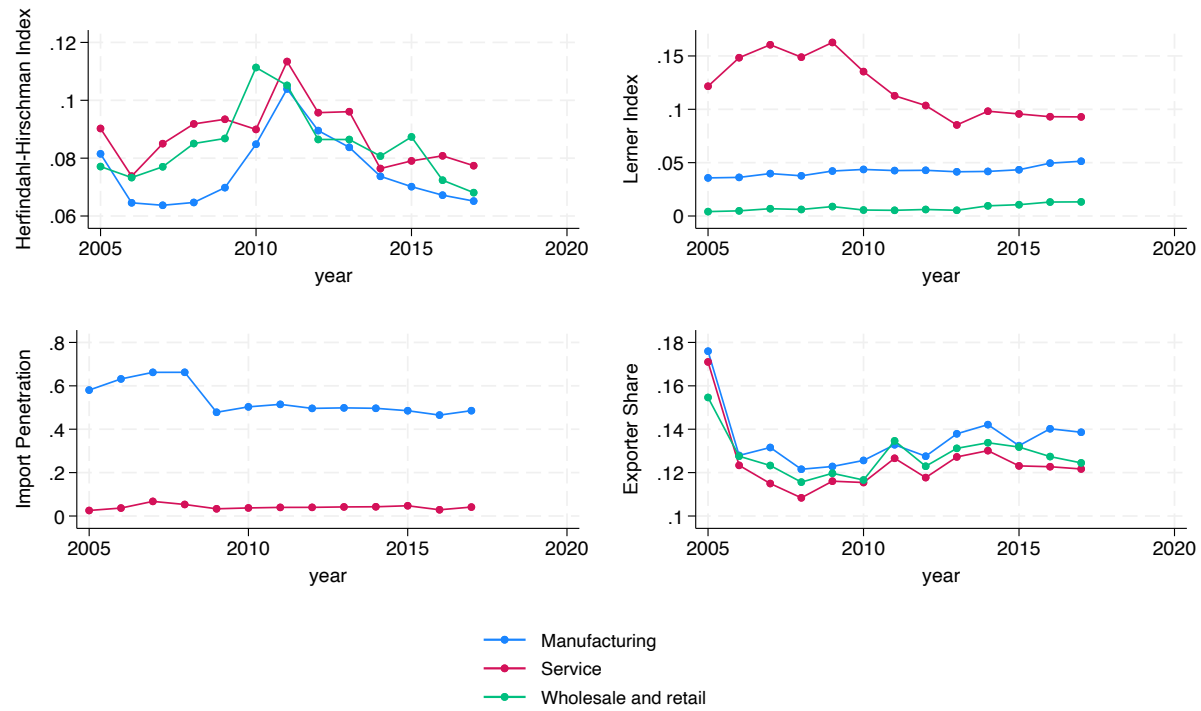
Source: ILO data

Figure 4. Survival estimates by sectors



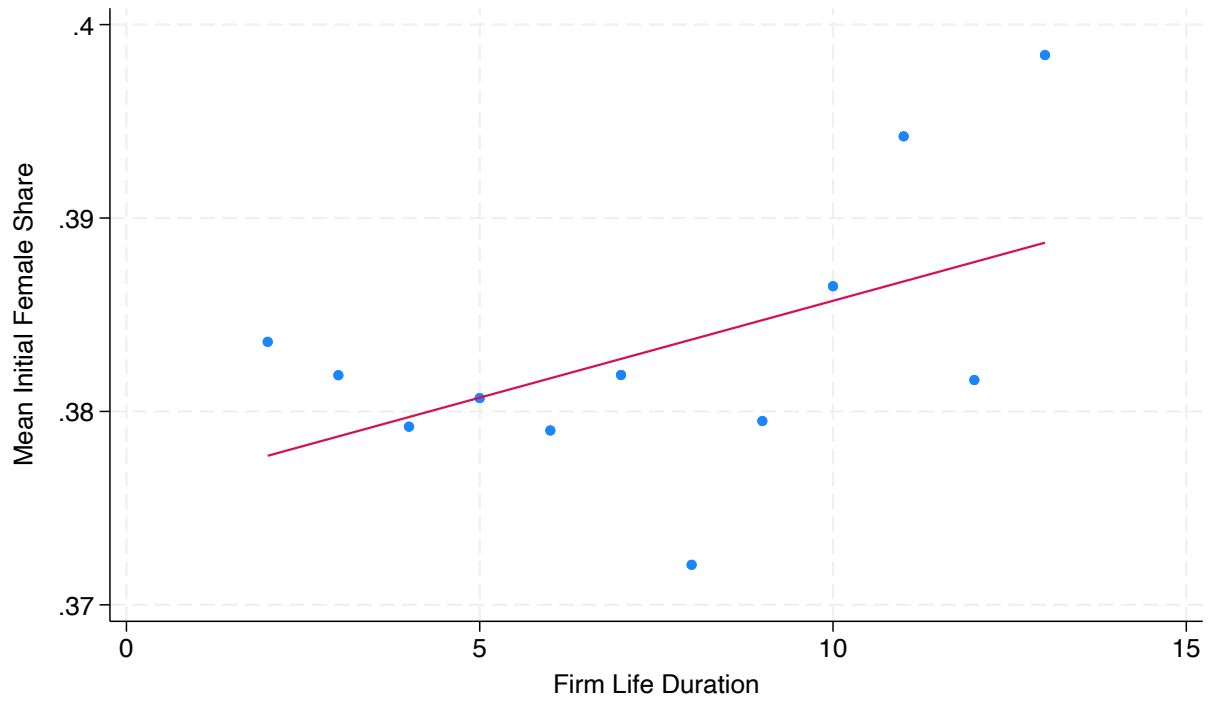
Source: The VES

Figure 5. Competition measure trends in Vietnam, 2005-2018



Sources: The VES and WITS

Figure 6. Firm-life duration and female share



Sources: The VES